

USER'S GUIDE

DPM-III

Universal Biometer

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BIO-TEK[®]
INSTRUMENTS, INC.

WARNING

The Universal Biometer is designed to measure positive or negative pressures from pneumatic or hydraulic devices only. It is not a direct patient-related device.

Never use the Universal Biometer to measure a patient's blood pressure or to perform any other direct pressure measurement. Bio-Tek will not be responsible for any liabilities resulting from such use.

Do not apply pressures above 125 psi to the Universal Biometer. Permanent damage to the Model DPM-III can result from excessive pressure applications.

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INTRODUCTION

The Bio-Tek Instrument's Universal Biometer Model DPM-III is a light-weight hand-held pressure and temperature meter. Pressures from various sources can be measured in psi, mmHg, cmH₂O, inH₂O, or kPa. A male luer lock fitting accommodates stopcocks and pressure fittings.

Temperatures can be measured in either degrees centigrade or Fahrenheit with any Yellow Springs 700 series probes. Both the temperature and pressure readings are displayed on the large liquid crystal display (LCD). Temperature and pressure can also be monitored over a period of time via the high level output jack (1/4" phono).

APPLICATIONS

The Universal Biometer can be used to measure and calibrate positive or negative pressures from both pneumatic and hydraulic sources as well as to test equipment for temperature accuracy. With the optional parabolic flow adapter (PFA-1), general flow rates can be measured from 10 to 250 lpm for a variety of gasses with an accuracy of $\pm 5\%$. Some of the equipment with which the Universal Biometer can be used include:

Pressure

- pneumatic tourniquets
- sphygomanometers
- non-invasive blood pressure monitors
- ventilators
- compressor pumps
- volumetric infusion pumps
- drainage devices
- irrigation systems
- dialysis machines
- pressure transducers
- pressure gauges
- vacuum gauges
- manometers

Temperature

- blood warmers
- heart-lung bypass units
- heating pads
- hemodialysis units
- humidifiers
- nebulizers
- hypo/hyperthermia units
- infant incubators
- radiant warmers
- temperature monitors

SPECIFICATIONS

High level output jack	1/4" phono jack
Voltage requirement	one 9 volt alkaline battery
Current consumption	14 mA
Battery life	32 h continuous use (BATT indicator on LCD for low battery)
Operating temperature range	10° to 40° C (50° to 104° F)
Dimensions	14.6 cm x 8.9 cm x 5.4 cm (5.7" x 3.5" x 2.1")
Weight	280 g (10 oz)

Pressure

Ranges	-698 to +776 mmH ₂ O -949 to +1055 cmH ₂ O -374 to +415 inH ₂ O -93 to +103 kPa -13.5 to +15 psi -13.5 to +100 psi
Linearity (all scales except 100 psi)	±0.5%
Linearity (100 psi scale)	±1%
Accuracy (all scales except 100 psi)	±1% of reading (up to 15 psi)
Accuracy (100 psi scale)	±2% of reading
Repeatability and hysteresis	0.15%
Overpressure	125 psi (1 ___ LCD indication)

Temperature

Measurement range	0° to 50° C (32° to 122° F)
Accuracy	±0.4° C (±0.7° F)
Resolution	0.1° C (0.2° F)
Temperature probe jack*	1/4" phono jack

* Temperature probes are designed for use with all Yellow Springs Instrument Company 700 series probes.

ACCESSORIES

<u>Description</u>	<u>Quantity Supplied</u>	<u>Bio-Tek Part Number</u>
General Probe	Optional	48148
Air Probe	Optional	48149
Surface Probe	Optional	48150
Catheter Adapter	1	49160
User's Guide	1	94069
Certificate of Calibration (NBS)	1	-
Warranty Card	1	-
Case	Optional	7770111
PFA-1 Parabolic Flow Adapter	Optional	-

DESCRIPTION

The Universal Biometer has an 8-position SELECTOR SWITCH to select the output range (see Figure 1). Readings are displayed on the LCD. An external ZERO KNOB allows quick zero adjustment when the unit is vented to atmosphere (for pressure only). Any pressure source can be connected to the Universal Biometer via the male LUER LOCK.

Temperature probes (700 series) can be connected by a PHONO PLUG to the 1/4" PHONO JACK for accurate temperature measurement when the unit is switched to either $^{\circ}\text{C}$ or $^{\circ}\text{F}$.

1. **General Purpose Probe:** Rugged vinyl-tipped probe. Use for measuring water temperatures.

NOTE: Immerse the probe for a short time only.

2. **Air Probe:** Stainless steel probe. Use for measuring temperatures of test rooms, incubators, remote air readings, and for monitoring of gas streams.
3. **Surface Probe:** Rugged stainless steel, epoxy-backed cup probe. Use for measuring heat loss.

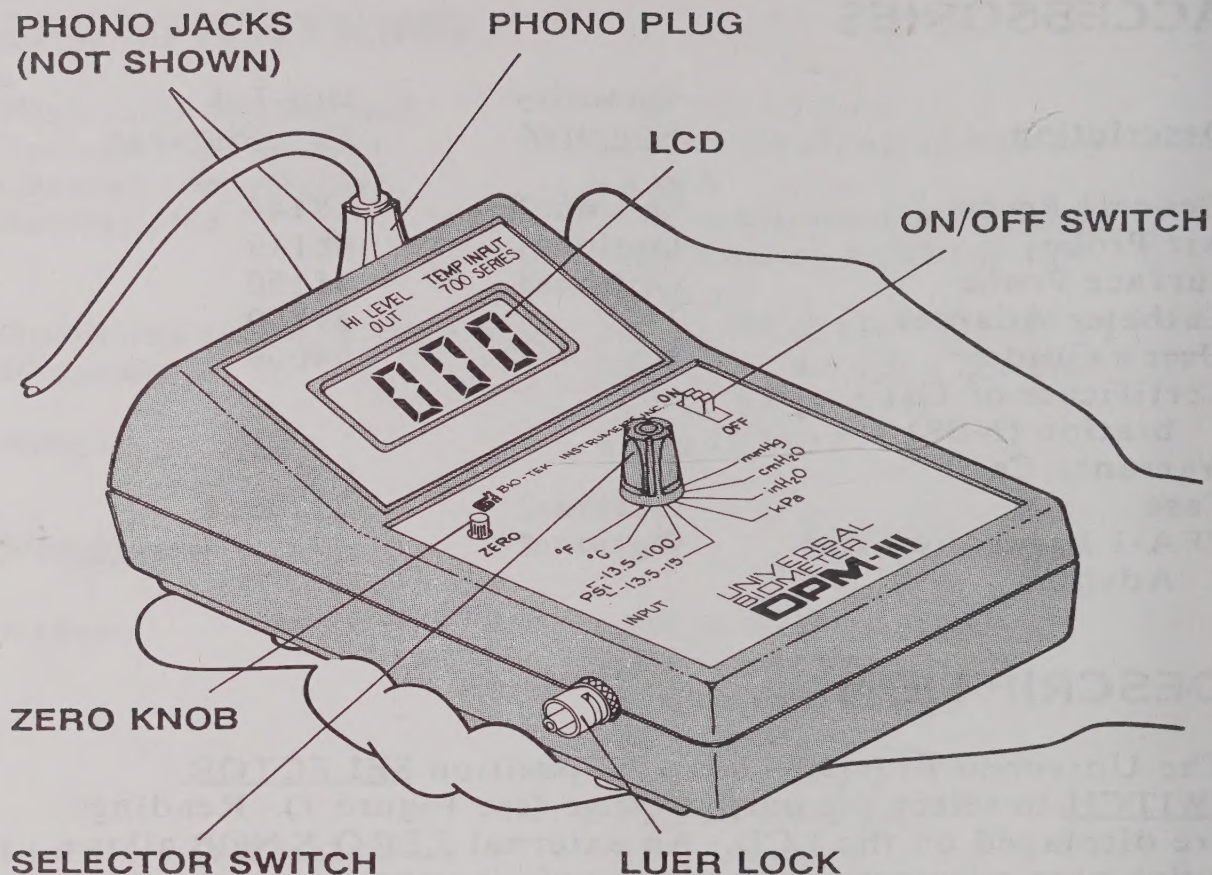


Figure 1. Universal Biometer Front Panel

The high level output for both pressure and temperature is obtained via another 1/4 " phono jack whenever the Model DPM-III ON/OFF SWITCH is switched ON.

PRESSURE OPERATION

1. Set the pressure SELECTOR SWITCH to the pressure range to be measured.
2. Zero the Universal Biometer (vented to atmosphere) by turning the front panel ZERO KNOB.

NOTE: The Universal Biometer may take a few seconds to settle to zero when first turned ON.

3. Connect the source of the pressure to the input (LUER LOCK) of the Universal Biometer.

NOTE: A stopcock or male-to-female luer lock adapter may be needed for the connection desired.

A catheter adapter has been provided for connections to various sizes of tubing.

4. Observe the pressure reading on the Universal Biometer. The biometer should indicate the pressure in the units of measure selected.
5. Use the a 1/4" PHONO JACK labeled Hi level out for term pressure monitoring. The jack provides output to a chart recorder.
6. Check the tubing and tubing connections if a 1 ___ ___ is displayed on the far left and all other digits are blanked out. The 1 ___ ___ indicates that the limits of the selected range have been exceeded.

NOTE: Hospital-grade tubing can normally be used for all connections between the pressure source and Universal Biometer; however, use rigid tubing for negative pressures.

NOTE: Use securely clamped, reinforced tubing for high pressures (above 5 psi or below -5 psi.)

Specific Pressure Applications

The Universal Biometer is used to:

1. Check static cuff pressure and cuff pressure variations (see Figures 2 through 5) for:
 - pneumatic tourniquets
 - sphygomanometers
 - non-invasive blood pressure monitors.

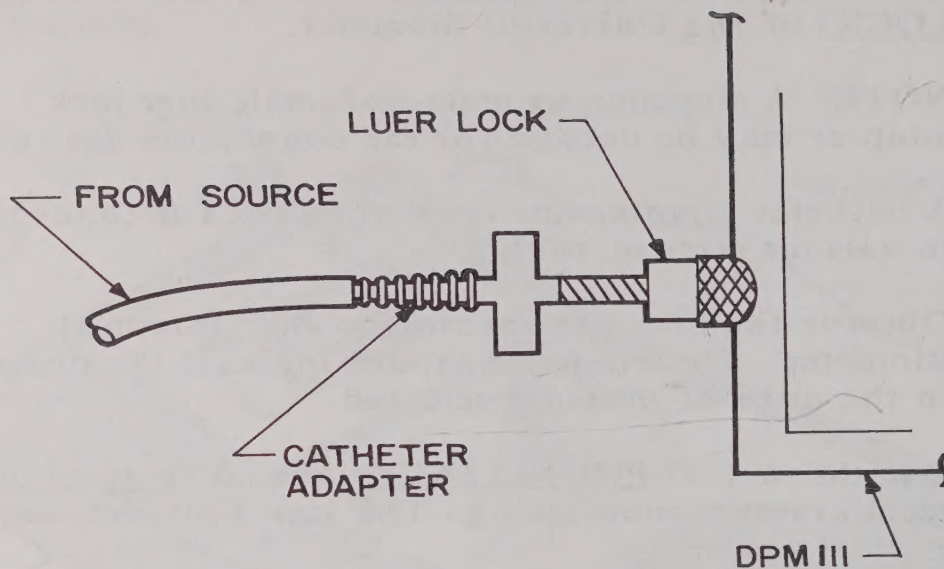


Figure 2. Standard Model DPM-III to Catheter Connection

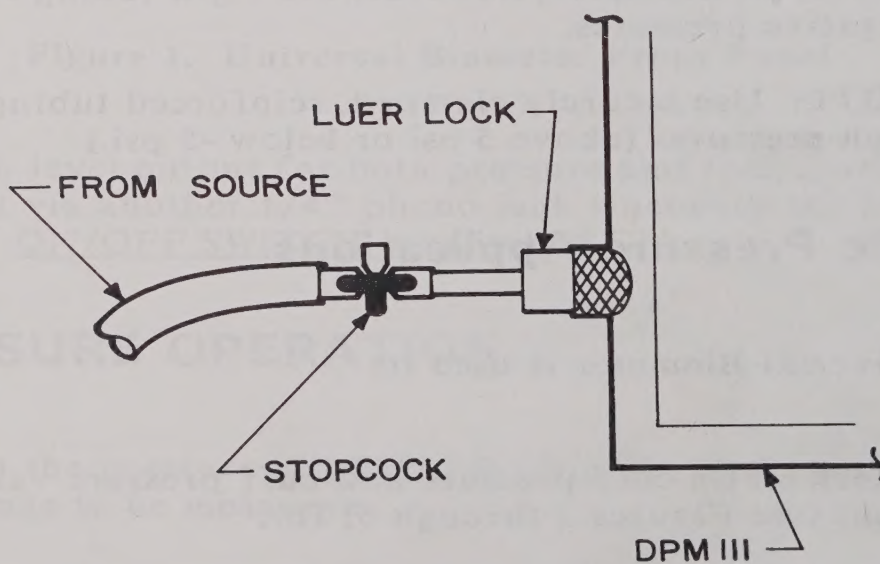


Figure 3. Standard Model DPM-III to Stopcock Connection

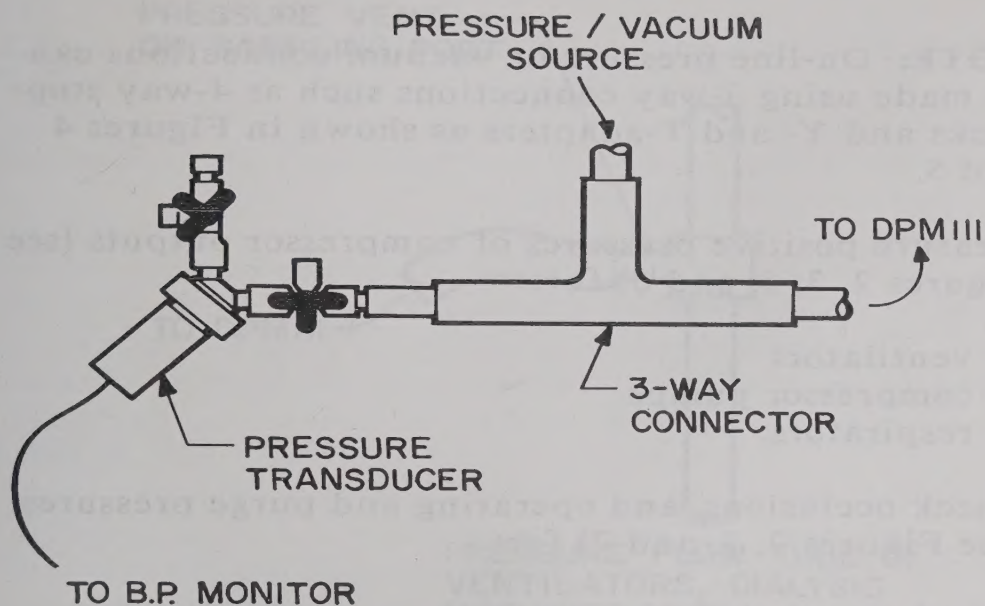


Figure 4. Standard Model DPM-III to Transducer Connection

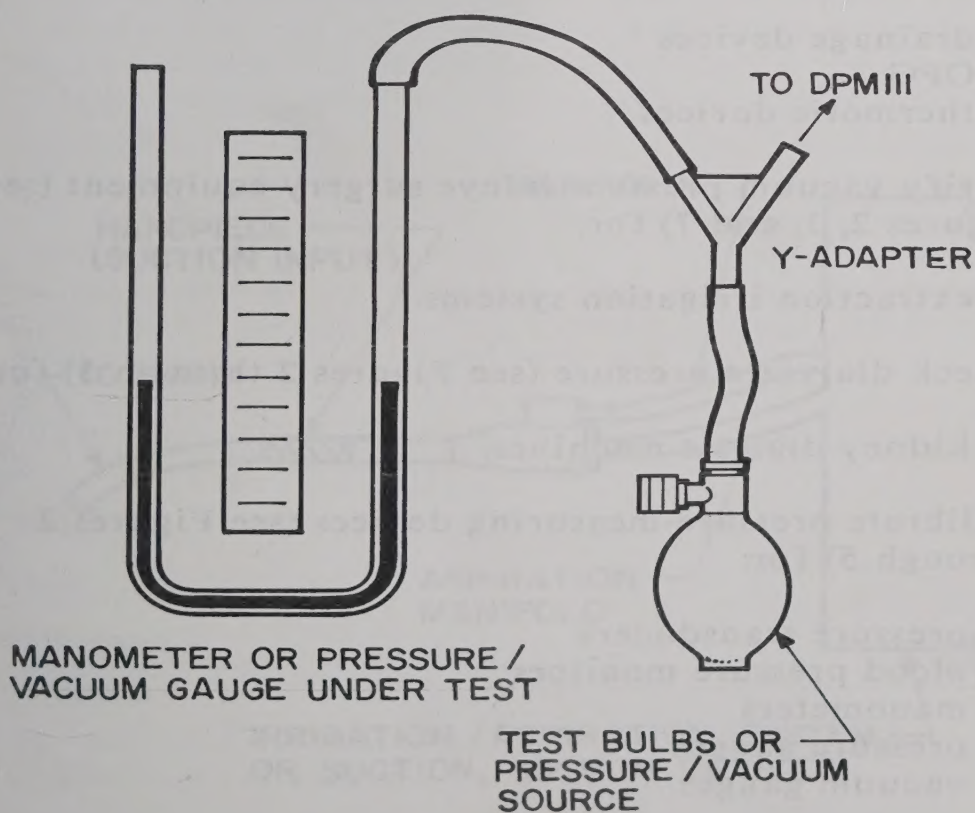


Figure 5. Standard Model DPM-III to Manometer Connection

NOTE: On-line pressure or vacuum connections can be made using 3-way connections such as 4-way stopcocks and Y- and T-adapters as shown in Figures 4 and 5.

2. Measure positive pressures of compressor outputs (see Figures 2, 3, 5, and 6) for:
 - ventilators
 - compressor pumps
 - respirators.
3. Check occlusions, and operating and purge pressures (see Figures 2, 3, and 7) for:
 - volumetric infusion pumps.
4. Verify negative pressures in diagnostic and surgical suction equipment (see Figures 2, 3, 5, and 6) for:
 - drainage devices
 - OPG
 - thermotic devices.
5. Verify vacuum pressure in eye surgery equipment (see Figures 2, 3, and 7) for:
 - extraction irrigation systems.
6. Check dialysate pressure (see Figures 2 through 5) for:
 - kidney dialysis machines.
7. Calibrate pressure-measuring devices (see Figures 2 through 5) for:
 - pressure transducers
 - blood pressure monitors
 - manometers
 - pressure gauges
 - vacuum gauges.

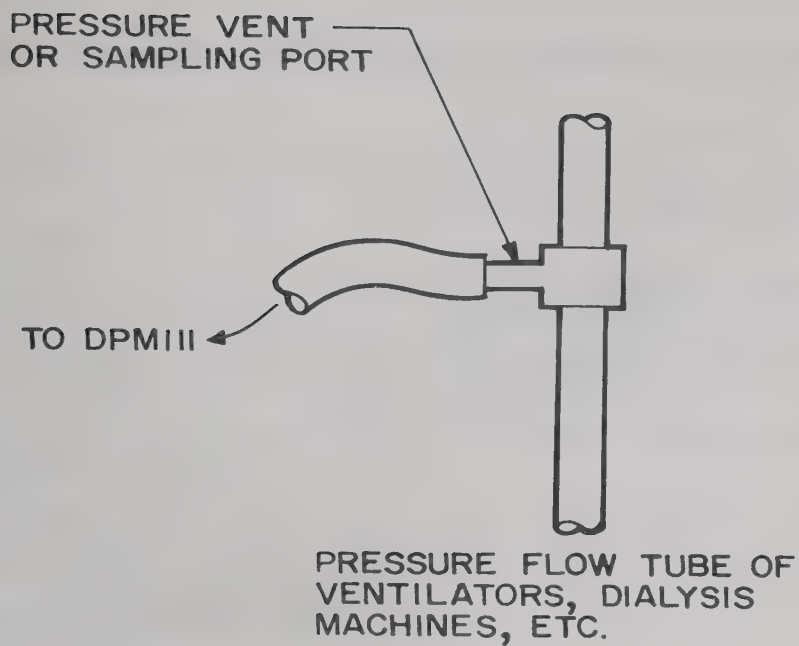


Figure 6. Standard Model DPM-III to Flow Device Connection

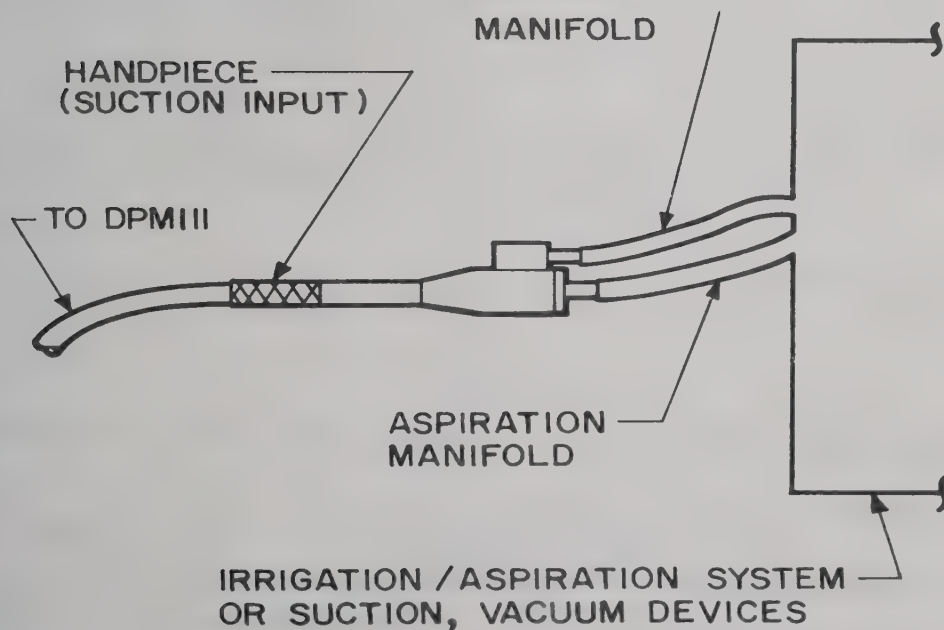


Figure 7. Standard Model DPM-III to Vacuum Device Connection

Gas and Liquid Pressure Measurements

1. **Air:** Make the necessary connections and measure or calibrate the source pressure.
2. **Gas and Gaseous Mixtures:** Let the gas or gaseous mixture bleed air from the tube connected to the source into the atmosphere. **Do this before connecting the tube to the Universal Biometer.** This insures that a homogeneous medium will be measured for pressure.
3. **Liquid Mediums:** The microswitch (transducer) used in the Universal Biometer has a thermoplastic-polyester (GE-valox) housing. Water and other solvent (liquid) pressures can be measured if the pH is in the range $6.5 < \text{pH} < 7.5$.

RECOMMENDATION: Use a syringe to flush the Universal Biometer pressure chamber with water after each use to prevent corrosion.

An ordinary syringe can be used to fill the pressure chamber with the liquid medium before making the tubing connection required for pressure measurements.

The following liquids can be used at room temperature and 100% concentration (unless otherwise noted):

Acetic acid (5%)

Ethylene glycol

Acetone

Ethylene oxide

Ammonia (30 — 35%)

Formaldehyde (37%, 60° C, 140° F)(88% freon, 12% ETO)

Benzaldehyde

Benzyl alcohol

Formalin (15% methyl alcohol, 37% formaldehyde)

Boiling water (60° C, 140° F)

Hydrochloric acid (10%)

Ethyl alcohol

Hydrogen peroxide
(10%, 30%)

Methanol vapor

Methyl alcohol

Oleic acid

Potassium permanganate

Sodium hydroxide (10%)

Sodium hypochlorite (10%)

Steam, dry heat
(149° C, 300° F)

TEMPERATURE

1. Set the SELECTOR SWITCH to the temperature scale to be measured (° C or ° F).
2. Attach the appropriate temperature probe to the 1/4" phono jack labeled TEMP OUTPUT 700 SERIES. Bio-Tek offers either air, surface, or general purpose probes for use with the Universal Biometer. Any Yellow Springs 700 series probe can be used with the Universal Biometer. (Refer to the Description Section for the information required to select a probe.)
3. Use the 1/4" phono jack labeled HI LEVEL OUT for term temperature monitoring. The jack provides output to a chart recorder or oscilloscope. (Remember: The HI LEVEL OUT jack can be used with any output setting on the SELECTOR SWITCH.)

NOTE: The user must supply a connector for this output (see Figure 8).

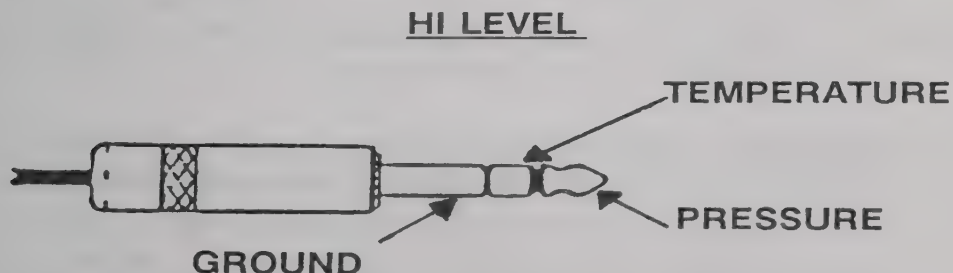


Figure 8. Connector to Chart Recorder or Oscilloscope

Specific Temperature Applications

NOTE: *All temperature comparisons should take into account the accuracy of the Universal Biometer, the unit under check, and the probes. The expected temperature readings must reflect this combined accuracy.*

BLOOD WARMERS

1. Check the heat exchanger temperature of the water-bath (general probe required).
1. Immerse the Universal Biometer probe into the center of the bath. Do not touch the probe to the sides of the warmer.
2. Allow the temperature reading to equilibrate.
3. Measure and record the temperature of the water-bath.
4. Compare the temperature reading on the biometer's LCD with the temperature setting on the blood warmer.
5. Allow the warmer to run continuously for 5 minutes while recording the temperature; use the HI LEVEL OUT jack on the biometer to measure fluctuations in temperature.

NOTE: Record the temperature change every 15 seconds to accurately monitor the temperature fluctuations.

6. Record the equilibrated temperature at the end of 5 minutes and compare with the temperature changes during the 5-minute interval.

NOTE: The temperature reading of the water in the waterbath and any temperature fluctuations should be within the manufacturer's specifications.

2. Check the heat exchanger temperature of dry heat blood warmers (surface probe required).
 1. Apply a heat-sink compound to the biometer probe and attach it to the surface of the heat exchanger.
 2. Repeat the temperature test in Item 1, Steps 2 through 5, preceding. (The dry-heat temperature is tested in a manner analogous to the waterbath temperature.)
3. Check the temperature of the fluid within the blood bag (general probe required).
 1. Fill a blood bag with water.
 2. Provide a waste receptacle to catch the effluent from the blood bag during testing.
 3. Attach a T-adapter to the blood bag opening and tubing to the opposite end of the adapter. (The tubing enables the water to flow into the waste receptacle.)
 4. Place the blood bag in the blood warmer being tested.
 5. Insert the temperature probe of the Universal Biometer into the free arm of the T-adapter.
 6. Allow the water to exit from the blood bag and measure the temperature of the water.

NOTE: The blood warmer should maintain the temperature of the water within the bag at the temperature specified by the blood warmer manufacturer. The specific output temperature should be maintained at flow rates of 0, 50, 100, and 150 ml/minute.

4. Check over-temperature safety features (general probe required).

1. Set up as in Item 3, Steps 1 through 5, preceding.
2. Refer to the manufacturer's operating manual to locate the primary thermostat of the blood warmer.
3. Bypass the primary thermostat and allow the unit to heat.
4. Measure and record the temperature of the water in the bag.

NOTE: The secondary thermostat in the blood warmer should prevent the temperature from exceeding the manufacturer's specified maximum temperature.

HEART/LUNG BYPASS UNITS

1. Check the thermometer accuracy (general probe required).
1. Locate the outflow line of the heater/cooler or mixer on the bypass unit.
2. Connect a T-adapter with the the outflow line.
3. Plug the general probe into the TEMP INPUT 700 SERIES phono jack on the universal Biometer.
4. Insert the biometer probe into the free arm of the T-adapter that is connected to the outflow line of the bypass unit.
5. Measure the temperature of the fluid that circulates in the bypass unit. The temperature reading on the biometer should be within the manufacturer's accuracy specifications for the temperature setting on the bypass unit.

6. Temperature fluctuations in the fluid outflow line can also be measured by using the HI LEVEL OUT jack on the biometer.

2. Check the temperature alarms (general probe required).

1. Connect as in BLOOD WARMERS Item 4, preceding, to create a high temperature alarm condition.

NOTE: The unit should register an alarm condition on the meter and should sound an audible alarm when the maximum operating temperature has been reached as specified by the manufacturer.

In addition to checking the temperature accuracy of heart/lung bypass units, the biometer can be used to measure the pressure of the blood returning to the patient. Refer to the PRESSURE OPERATION section for procedures for measuring pressure.

HEATING PADS

1. Check the operating temperature (general or surface probe required).
1. Attach the surface probe of the biometer to a patient phantom (metal piece 3" x 3" or other as available).
2. Wrap the heating pad around the probe and phantom.
3. Wrap insulation around the pad to minimize heat dissipation.

4. Measure and record the temperature readings displayed on the biometer for high, low, and any other desired settings on the heating pad.

NOTE: The accuracy should be within manufacturer's specifications.

5. Alternatively, insert a T-adapter (or the manufacturer's attachment) into the outflow of the heating pad and then measure the exiting fluid's temperature.
2. Check the over temperature safety features (general or surface probe required).
 1. Connect a general or a surface probe to the Universal Biometer.
 2. Refer to the heating pad manufacturer's operating manual to locate the primary thermostat.
 3. Bypass the primary thermostat and allow the unit to heat for at least 15 minutes.
 4. Measure the maximum temperature of the heating pad.

NOTE: The secondary thermostat in the heating pad should prevent the temperature from exceeding the manufacturer's specifications.

HEMODIALYSIS UNITS

1. Check the temperature accuracy (general probe required).
 1. Insert a T-adapter into the outflow of the hemodialysis unit.

2. Insert the general temperature probe of the Universal Biometer into the free arm of the T-adapter.
3. Set the temperature control on the hemodialysis unit to 37° C (98.6° F) with a flow rate of 500 ml/min or according to the manufacturer's specifications.
4. Allow the unit to stabilize for 15 minutes.
5. Measure the temperature of the exiting fluid and record the temperature displayed on the biometer. The displayed temperature should be within manufacturer's specifications.

NOTE: The HI LEVEL OUT jack on the biometer can be used to record temperature variations.

2. Check alarms.

1. Set up as in Item 1, Steps 1 through 5, preceding.
2. Test the accuracy of the high and low temperature alarms to ensure that they are within manufacturer's specifications.

In addition to checking the temperature accuracy of hemodialysis units, the Universal Biometer can be used to check the blood-circuit pressure accuracy and alarms. The pressure and alarms are checked by connecting a T-adapter in the blood circuit and inserting the biometer probe into the free arm of the T-adapter. For additional procedures for measuring pressure refer to the PRESSURE OPERATION section.

HUMIDIFIERS AND NEBULIZERS

1. Check the output temperature (general probe required).

1. Insert the temperature probe connected to the Universal Biometer into the T-adapter that has been connected to the outflow of the humidifier (or nebulizer).

NOTE: Place the T-adapter as close as possible to the humidifier's temperature sensor. The biometer measures the temperature of the steam emanating from the humidifier, not the water contained in the heating portion of the humidifier.

2. Set the humidifier to a nominal value (37° C, 98.6° F) with gas flow at 10 l/min.
3. Allow the system to equilibrate and compare the temperature setting of the humidifier to the reading displayed on the Universal Biometer.
4. Set the humidifier to maximum and note the temperature changes maximum temperature reading.

NOTE: Verify that the readings are within the manufacturer's specifications.

2. Check the alarms.

1. Verify that the high and low alarms respond to the levels stated in the manufacturer's specifications.

NOTE: The pressure drop through the unit with 10 l/min flow should be less than 5 cmH₂O.

In addition to testing the steam temperature of humidifiers and nebulizers, the Universal Biometer can be used to test

for leaks by pressurizing the humidifier and noting any pressure loss over time. Check the manufacturer's specifications for the maximum leak rate.

HYPO/HYPERTHERMIA UNITS

1. Check the fluid temperature accuracy (general probe required).
 1. Attach a T-adapter to the output of the hypo/hyperthermia device.
 2. Insert the probe connected to the Universal Biometer into the free arm of the T-adapter.
 3. Set the hypo/hyperthermia unit to its coolest setting.
 4. Measure and record the temperature displayed on the biometer.
 5. Repeat the test at the highest setting of the hypo/hyperthermia unit. Results should agree with the manufacturer's specifications.
- NOTE:** The HI LEVEL OUT jack can be used to record temperature variations.
2. Check the high and low temperature protection and/or alarms (general probe required).
 1. Refer to the manufacturer's operator's manual to bypass the primary thermostat (if applicable).
 2. Operate the unit in the maximum high and low settings to verify high and low temperature cut-offs according to the manufacturer's specifications.

3. Check the patient temperature sensor accuracy in the servo mode (general probe required).
1. Prepare a flask of water (30° — 40° C, 87° — 104° F).
2. Immerse the probe connected to the Universal Biometer into the flask as close as possible to the patient temperature sensor that is also immersed in the water.
3. Compare the temperature readings of the two devices. The biometer reading should be within the manufacturer's specifications for the patient temperature sensor.

INFANT INCUBATORS

1. Check the patient temperature sensor accuracy (general probe required).
1. Test the patient temperature sensor as in as in Item 3, Steps 1 through 3, preceding.
2. Test the alarms as in Item 2, Steps 1 through 3, preceding.
2. Check the hood air temperature accuracy (air probe required).
1. Place the Universal Biometer probe in the middle of the incubator at the mid-axillary line of the infant.
2. Verify that the incubator air temperature reading is within the manufacturer's specifications when the incubator temperature has equilibrated.
3. Use the HI LEVEL OUT jack on the Universal Biometer to verify the various temperature settings

and monitor temperature variations in the infant incubator.

3. Check the over safety thermostat (air probe required).

1. Bypass the primary thermostat as described in BLOOD WARMERS, Item 4.
2. Verify that the operation of the safety thermostat as in HYPO/HYPERTHERMIA, Item 2, Steps 1 and 2.

RADIANT WARMERS

A general probe is required when testing radiant warmers.

1. Attach the probe connected to the Universal Biometer to a surface that is placed at the same distance as the patient or object to be warmed.
2. Place the patient temperature sensor as close as possible to the probe attached to the biometer to verify the accuracy of the radiant warmer.
3. The points where the warmer turns ON or OFF should be within the manufacturer's specifications.
4. Check the warmer alarm accuracy against the manufacturer's specifications by bypassing the primary thermostat in the radiant warmer and allowing the warmer to heat until the alarm switches the device OFF.

TEMPERATURE MONITORS

Select an air, general, or surface probe depending on the type of temperature monitor to be tested and the application. Be sure to test each temperature monitor for:

1. temperature accuracy according to the manufacturer's specification (including testing the device for upper, lower, and several intermediate temperatures),
2. any over-temperature features that are discussed in the operator's manual, and
3. alarm features that indicate that the unit has reached an upper or lower limit of its temperature measuring range.

BATTERY REPLACEMENT

When BATT is indicated on the Universal Biometer, the battery power is low and the battery should be replaced. Remove the cover of the external battery compartment on the back of the unit. Replace the used battery with a 9 V alkaline battery.

SERVICE INFORMATION

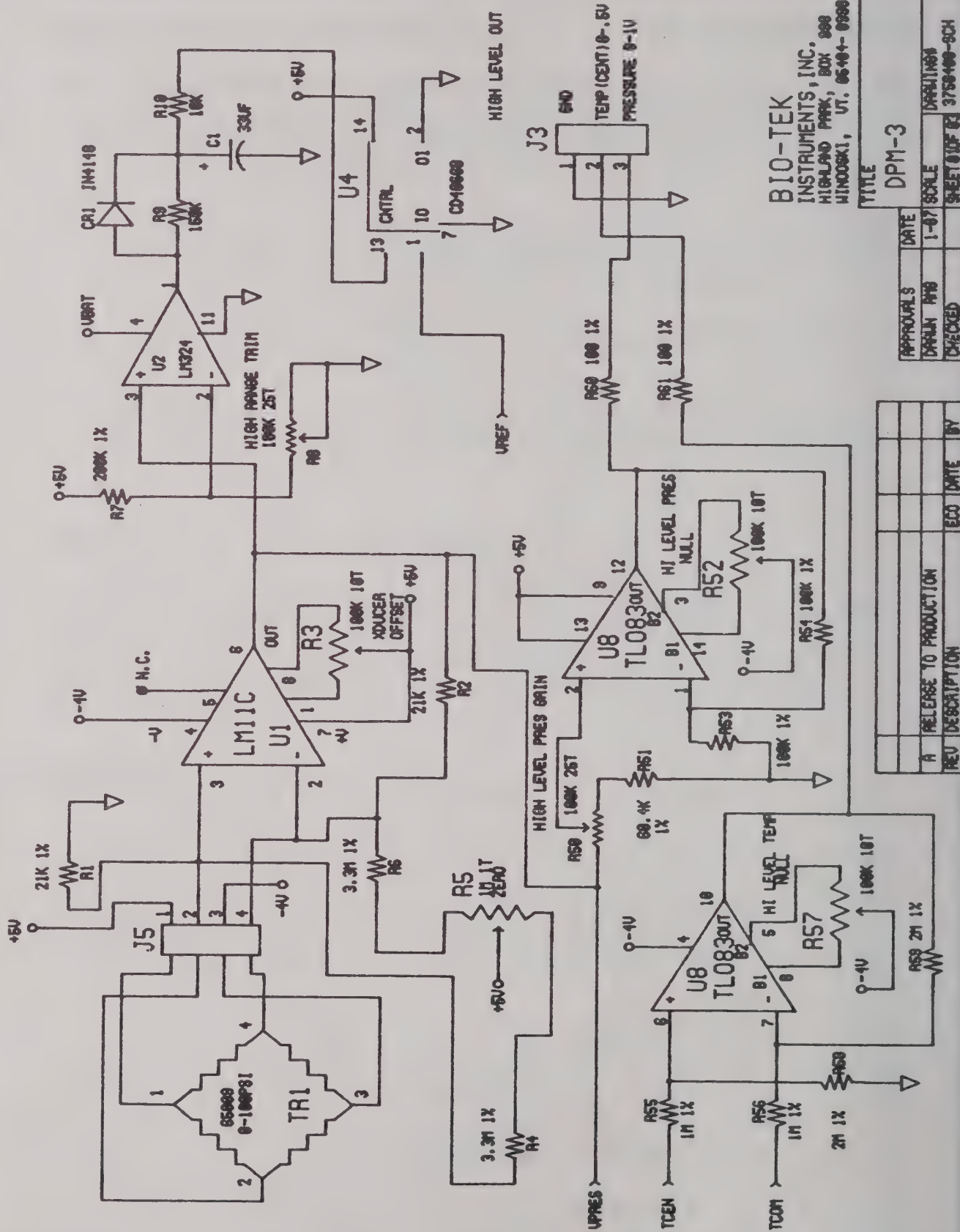
The Universal Biometer should be returned to the factory if repairs are required. Contact our Customer Service Representatives to obtain a **Return Authorization Number** at the numbers provided following the Bio-Tek address. Pack the unit carefully, insure for the full retail value, and return to:

Bio-Tek Instruments, Inc.
Highland Park, Box 998
Winooski, VT 05404-0998
Attn: Service Department

1-800-242-4685 (SERVICE)
1-800-451-5172
TELEX 94-0136 BIO TEK SHVT
FAX 1-802-655-7941

SCHEMATICS

The following schematics should enable users who are familiar with electronic design to service and repair the Universal Biometer. All questions pertaining to the Universal Biometer should be directed to the Bio-Tek Service Department.



BIO-TEK
INSTRUMENTS, INC.
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WINOCHKI, UT. 84604-0990

TYPE
DPM-3

APPROVALS	DATE
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RELEASE TO PRODUCTION	ECO	DATE	BY
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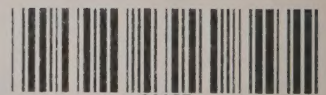
WARRANTY

Refer to the Warranty Card shipped with your unit for specific warranty information.

GENERAL ELECTRIC
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